Magmatic-hydrothermal transition traced by in situ tourmaline analysis at the San Rafael tin deposit, Peru

HARLAUX, Matthieu, et al.

Abstract
Tourmaline is commonly an accessory, locally abundant, mineral in granite-related hydrothermal Sn deposits and records information about the nature and evolution of mineralizing fluids and ore-forming processes. The world-class San Rafael lode-type Sn deposit, located in the northern part of the Andean Tin Belt in southern Peru, is characterized by volumetrically important tourmaline alteration, which resulted from massive fluid-rock interaction. Based on their paragenetic position, several generations of tourmaline have been identified in the San Rafael deposit both of magmatic and hydrothermal origin. They correspond to three major episodes of tourmaline formation that were characterized texturally and compositionally (major and trace elements, and oxygen isotopic signatures) by in situ analysis (SEM, EPMA, LA-ICP-MS, SIMS). The first one, magmatic tourmaline, is found in peraluminous granites. It is texturally homogeneous, has dravite composition with high Li, K, Na, and Zn contents, and shows a narrow range of δ18O values (10.4-11.6 ‰). The second episode corresponds to hydrothermal tourmaline formed during [...]
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Harlaux M.1*, Kouzmanov K.1, Gialli S.1, Laurent O.2, Marger, K.3, Baumgartner L.3, Dini A.4, Chauvet A.5, Kalinaj M.6, and Fontboté L.1

1 Department of Earth Sciences, University of Geneva, Switzerland. *matthieu.harlaux@unige.ch
2 Institute of Geochemistry and Petrology, ETH Zürich, Switzerland
3 Institute of Earth Sciences, University of Lausanne, Switzerland
4 Istituto di Geoscienze e Georisorse, CNR Pisa, Italy
5 Géosciences Montpellier, Université de Montpellier, France
6 Minsur SA, Jr. Lorenzo Bernini 149, San Borja, Lima, Peru

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